Notes For Forest Managers

Missouri Department of Conservation

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Girard Form Class Trends from the Missouri Ozark Forest Ecosystem Project

Girard Form Class is a measure of taper of the first 16-foot log in a tree (Girard, 1933). It has been widely used in the United States to adjust log volume estimates for trees with different taper. Most American log volume tables state the Girard Form Class used or the average assumed taper.

Girard Form Class is defined as follows:

$$Gfc = \frac{dib_{u17.3}}{dbh} * 100$$

where *Gfc* = Girard Form Class,
dib = diameter inside bark,
dbh = diameter at breast height (outside bark)

Girard Form Class is the ratio of the diameter inside bark ($dib_{u17.3}$) at 17.3 feet above the ground over the diameter at breast height (*dbh* outside bark) times 100. As the number becomes larger, the total volume in the log becomes greater. A form class approaching 100 means the log is nearly a cylinder. The smaller the form class, the greater the taper in the log. Girard Form Class can be important since the difference between two adjoining classes (e.g., 84 and 85) can be about 3 percent difference in merchantable volume (Avery and Burkhart, 1994).

MOFEP field measurements for upper stem diameters were taken outside bark at 17.5 feet ($dob_{u17.5}$) as opposed to the usual $dib_{u17.3}$. This was a practical compromise because the original data was taken on standing trees. Changing from *dib* to *dob* will increase the upper stem diameter by double the bark thickness, while the increase in measurement height would help compensate for the upper stem diameter difference. The net effect of this difference is that the form class values reported here are slightly higher than would be expected using the traditional form class.

Upper stem diameters were taken on a subsample of trees from all 648 MOFEP vegetation plots. In all, 8,187 trees of 11 different species were measured. Four species had less that three trees measured. Seven species are reported.

Table 1 presents the Girard Form Class from the MOFEP data. The table is organized by species and total height classes and lists the number of trees in the subclass, the mean Girard Form Class for the subclass, the minimum and maximum Girard Form Class in the subclass and the standard deviation for the subclass. The standard deviation can be thought of as describing the range for about 2/3 of the data in the subclass (mean $\pm$ 1 standard deviation).

This table is presented as a guide to understanding the relationship between total height class, species and tree taper on the MOFEP

ABSTRACT

More than 8,000 trees from Missouri Ozark Forest Ecosystem Project plots were analyzed for Girard Form Class. Taper is slightly less on MOFEP sites that the generally accepted average of 78. Some of the reduction in taper can be attributed to the different way form class was measured on MOFEP sites. This study can help foresters select the appropriate volume table to use with trees similar to those found on MOFEP.

sites and can help foresters select the appropriate volume table to use with trees that are similar to those found on the MOFEP sites.

Overall, taper is slightly less on MOFEP sites that the generally accepted average of 78. Some of the reduction in taper can be attributed to the different way form class was measured on MOFEP sites versus the standard method. Taller trees such as black oak, scarlet oak and shortleaf pine have the least taper. Shorter trees have more taper, and particularly blackjack oak has the most taper. The real value of this information is to guide foresters in identifying the situations in which average volume estimation may be inadequate.

Further Reading

Girard, J. W. 1933. Volume tables for Mississippi bottomland hardwoods and southern pines. J. For. 31:34-41.

Husch, B., C. I. Miller and T. W. Beers, 1993. Forest Mensuration, Krieger Publishing Co., Malabar, Florida. 402 pp.

Avery, T. E. and H. E. Burkhart. 1994. Forest Measurements, McGraw-Hill, New York. 408 pp. (see page 114).

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The Missouri Ozark Forest Ecosystem Project generated the data for this Note.

Invitation for Submissions

Authors are invited to submit manuscripts for Notes for Forest Managers. Notes should be field oriented and relevant to forest land management. Submissions may be sent to:

Forestry Research Section
Missouri Department of Conservation
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Columbia, MO 65201

Notes for Forest Managers are also posted on the Missouri Department of Conservation web page at <www.conservation.state.mo.us>.

Table 1. Number, mean, minimum, maximum and standard deviation of Girard Form Class by species and total height class.

Height class (feet)	Number	Mean Form Class	Minimum	Maximum	Standard Deviation
All Species					
30-39	914	71	50	96	8.9
40-49	1607	77	53	98	7.6
50-59	1770	81	53	99	6.9
60-69	1909	85	52	99	6.0
70-79	1337	86	60	99	5.4
80-89	516	87	61	98	5.3
90+	134	88	73	99	4.8
Average	8187	81	50	99	8.4
Shortleaf Pine (*Pinus echinata*)					
30-39	146	73	54	94	8.5
40-49	238	79	57	98	7.2
50-59	312	84	60	99	6.2
60-69	443	87	68	98	4.9
70-79	284	87	77	99	6.5
80-89	49	89	76	97	4.5
90+	8	88	78	94	5.3
Average	1479	84	54	99	7.4
Black Oak (*Quercus velutina*)					
30-39	55	69	50	96	12.0
40-49	183	76	54	98	8.8
50-59	348	81	53	98	7.7
60-69	549	84	52	98	6.3
70-79	442	86	67	97	5.3
80-89	189	86	63	97	5.3
90+	26	85	73	94	4.6
Average	1790	83	50	99	7.7
White Oak (*Quercus alba*)					
30-39	474	70	50	92	9.9
40-49	765	76	53	96	7.2
50-59	599	81	56	97	6.4
60-69	408	84	61	98	6.1
70-79	204	85	60	98	6.7
80-89	55	86	69	97	5.8
90+	13	88	76	97	4.9
Average	2508	79	50	98	8.5

Table 1. Continued

Height class	Number	Mean Form Class	Minimum	Maximum	Standard Deviation
Scarlet Oak (*Quercus coccinea*)					
30-39	111	70	50	94	9.7
40-49	234	77	54	94	7.8
50-59	292	81	56	99	7.2
60-69	379	86	70	99	5.4
70-79	387	87	66	98	5.6
80-89	219	87	61	98	6.4
90+	87	89	78	100	4.7
Average	1702	83	50	100	7.9
Post Oak (*Quercus stellata*)					
30-39	105	67	50	88	9.2
40-49	159	75	56	92	7.8
50-59	192	79	55	95	7.2
60-69	115	82	62	97	6.7
70-79	23	83	60	90	7.5
80-89	2	81	80	82	1.1
90+	0				
Average	591	77	50	97	8.8
Chinkapin Oak (*Quercus muehlenbergii*)					
30-39	24	71	58	88	9.3
40-49	12	80	66	91	8.1
50-59	18	84	73	99	7.3
60-69	10	86	74	96	6.8
70-79	0				
80-89	0				
90+	0				
Average	64	79	56	99	10.1
Blackjack Oak (*Quercus marilandica*)					
30-39	17	71	52	89	11.2
40-49	16	76	63	95	8.2
50-59	10	82	71	94	6.7
60-69	3	85	82	90	4.4
70-79	0				
80-89	0				
90+	0				
Average	46	76	52	95	10.0